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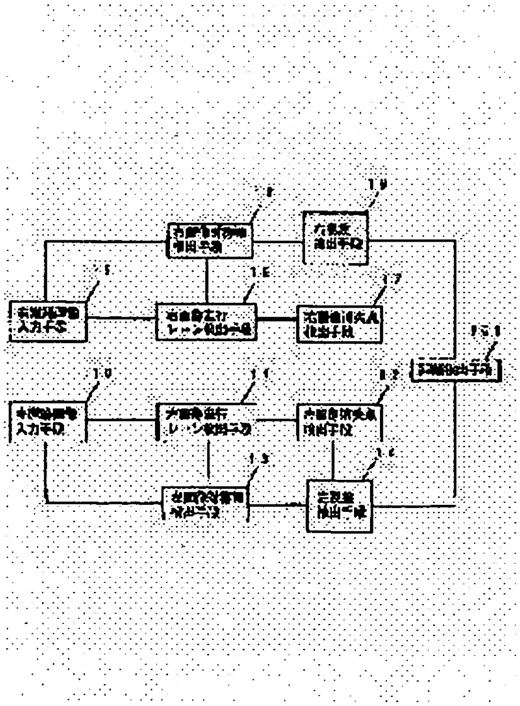
(54) DISTANCE-BETWEEN-CARS MEASURING APPARATUS, CAMERA-POSITION CORRECTION DEVICE AND COLLISION WARNING DEVICE

(57)Abstract:

PURPOSE: To measure a distance up to a vehicle in the front with a small computation amount.

CONSTITUTION: The front of a vehicle is photographed by right and left road- image input means 10, 15, white lines are detected as straight lines by running- lane detection means 11, 16, and their respective vanishing points are found by vanishing-point detection means 12, 17. Symmetry axes of the vehicle at the front are found by symmetry-axis detection means 13, 18, their respective parallaxes are extracted by right and left parallax extraction means 14, 19, and a distance up to the vehicle at the front is measured by a distance detection means 101 by using the parallaxes.



DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates to the distance-between-two-cars metering device, camera location compensator, and collision warning device which find the distance to front vehicles.
[0002]
[Description of the Prior Art] What sets up the existence region of front vehicles by one image, takes correlation of the image of the field and another side as an example of the conventional distance-between-two-cars metering device, and finds the distance to front vehicles is known (JP,4-41941,A).
[0003] Moreover, as conventional collision warning equipment, the method of finding the distance of front vehicles and self-vehicles with a distance detection means, and finding a relative speed with front vehicles from the temporal response of distance in a relative-speed-detector means is learned from the reflected light of the laser beam floodlighted by front vehicles with the laser beam floodlighting means (JP,1-213593,A). In the distance information extract means, the vehicles near the speed of self-vehicles are extracted based on said distance and relative velocity. With a pattern-matching means, the pattern which corrects the pattern of the reflected light memorized in the basic pattern storage means for the distance information on a distance information extract means, and corresponds is found. With an output means, the distance of front vehicles and a direction are computed and outputted from an applicable pattern.
[0004]
[Problem(s) to be Solved by the Invention] Since such a conventional distance-between-two-cars metering device was computing the distance to front vehicles by taking the image of draw another side, and correlation for forward vehicle both fields from one side of two image data as described above, there is much computational complexity, and it required time amount, and had the exact case where distance-between-two-cars measurement could not be carried out. Furthermore, in the conventional distance-between-two-cars metering device, since the road image input means on either side was rotating or inclinations differed, correlation of the image of forward vehicle both the fields and another side of one image might be unable to be taken.
[0005] Moreover, as described above, conventional collision warning equipment found laser only for a relative distance with front vehicles only by glaring ahead, and collision prediction time amount measurement of it by the migration direction or movement magnitude was not completed.
[0006] This invention aims at offering the distance-between-two-cars metering device with which computational complexity can measure the distance to front vehicles few, the camera location compensator which can perform amendment of a road image input means using an image, and the collision warning device which can take out the collision prediction time amount by the migration direction or movement magnitude, and can carry out the alarm of the collision to an operator in consideration of the technical problem of the above-mentioned conventional equipment.
[0007]
[Means for Solving the Problem] A left road image input means for this invention to be carried in left-hand side of vehicles, and to photo the front of vehicles, A left image transit rain detection means to detect a white line of a transit lane using image data from a left road image input means, and to approximate it in a straight line, A left image vanishing point detection means to ask for a vanishing point on an image from a straight line detected with a left image transit rain detection means, A left image symmetry-axis detection means to detect a symmetry axis of front vehicles in it in quest of a lane their own vehicles are running from a straight line detected with a vehicles front image from a left road image input means, and a left image transit rain detection means, A left parallax detection means to search for a horizontal difference of a location of a symmetry axis searched for with a left image symmetry-axis detection means, and a location of a vanishing point for which it asked with a left image vanishing point detection means, A right road image input means to be carried in right-hand side of

vehicles and to photo the front of vehicles, A right image transit rain detection means which detects a transit lane using image data from a right image input means, and transposes it to a straight line, A right image vanishing point detection means to ask for a vanishing point on an image from a straight line detected with a right image transit rain detection means, A right image symmetry-axis detection means to detect a symmetry axis of front vehicles in it in quest of a lane their own vehicles are running from a straight line detected with a vehicles front image from a right road image input means, and a right image transit rain detection means, A right parallax detection means to search for a horizontal difference of a location of a symmetry axis searched for with a right image symmetry-axis detection means, and a location of a vanishing point for which it asked with a right image vanishing point detection means, It has a distance detection means to detect distance of vehicles from a symmetry axis searched for with a left parallax detection means, a horizontal difference of a vanishing point, a symmetry axis searched for with a right parallax detection means, and a horizontal difference of a vanishing point to the front.

[0008] Moreover, a direction camera rotation signal output means of a yaw by which this invention outputs a rotation signal of the direction of a yaw, A direction rotation means of a left image input yaw to rotate a left road image input means according to a signal from the direction camera rotation signal output means of a yaw, A left road image input means to be carried in left-hand side of vehicles and to photo the front of vehicles, A left image transit rain detection means which detects a transit lane using image data from a left image input means, and transposes it to a straight line, A left image vanishing point detection means to ask for a vanishing point on an image from a straight line detected with a left image transit rain detection means, A left image disappearance line detection means to draw a vanishing point from a left image vanishing point detection means on image data based on a rotation signal from the direction camera rotation signal output means of a yaw, and to ask for a disappearance line, A camera setting data base containing location data on an image of a disappearance line, A left image input amendment angle detection means to search for an amendment angle of whenever [angle-of-inclination] from a location of a disappearance line on an image from [from a disappearance line on an image from a left image disappearance line detection means] an amendment angle and a camera setting data base of the circumference of an optical axis of a left image input means, A circumference rotation means of a left image input optical axis rotated to the circumference of an optical axis of a left road image input means based on an amendment angle of the circumference of an optical axis searched for with a left image input amendment angle detection means, A left image input inclination modification means to amend an inclination of a left road image input means based on an amendment angle of an angle of inclination searched for with a left image input amendment angle detection means, A direction rotation means of a right image input yaw to rotate a right road image input means according to a signal from the direction camera rotation signal output means of a yaw, A right road image input means to be carried in right-hand side of vehicles and to photo the front of vehicles, A right image transit rain detection means which detects a transit lane using image data from a right image input means, and transposes it to a straight line, A right image vanishing point detection means to ask for a vanishing point on an image from a straight line detected with a right image transit rain detection means, A right image disappearance line detection means to draw a vanishing point from a right image vanishing point detection means on image data based on a rotation signal from the direction camera rotation signal output means of a yaw, and to ask for a disappearance line, A right image input amendment angle detection means to search for an amendment angle of whenever [angle-of-inclination] from a location of a disappearance line on an image from [from a disappearance line on an image from a right image disappearance line detection means] an amendment angle and a camera setting data base of the circumference of an optical axis of a right image input means, A circumference rotation means of a right image input optical axis rotated to the circumference of an optical axis of a right road image input means based on an amendment angle of the circumference of an optical axis searched for with a right image input amendment angle detection means, It has a right image input inclination modification means to amend an inclination of a right road image input means based on an amendment angle of an angle of inclination searched for with a right image input amendment angle detection means.

[0009] Moreover, forward vehicle both closing rate detection means by which this invention detects a closing rate of front vehicles from distance information from self-vehicles of a fixed time interval from a distance detection means to front vehicles, It has a warning means to tell that there is a possibility of a collision with an operator from collision anticipation time amount from distance to front vehicles from a distance detection means, a collision time amount count means to find collision time amount from a closing rate of front vehicles from forward vehicle both closing rate detection means, and a collision time amount count means.

[0010]

[Function] In this invention, it is carried in the left-hand side of vehicles by the left road image input means, and the front of vehicles is photoed. With a left image transit rain detection means The white line of a transit lane is detected using the image data from a left road image input means, and it is approximated in a straight line. With a left image vanishing point detection means It asks for the vanishing point on an image from the straight line detected with the left image transit rain detection means. With a left image symmetry-axis detection means In quest of the lane their own vehicles are running, the symmetry axis of the front vehicles in it is detected from the straight line detected with the vehicles front image from a left road image input means, and the left image transit rain detection means. With a left parallax detection means A right road image input means to search for the horizontal difference of the location of the symmetry axis searched for with the left image symmetry-axis detection means, and the location of the vanishing point for which it asked with the left image vanishing point detection means, and for the same thing to be carried on the right-hand side of vehicles, and to photo the front of vehicles, A right image transit rain detection means, a right image vanishing point detection means, a right image symmetry-axis detection means, and a right parallax detection means perform. With a distance detection means The distance of the vehicles from the symmetry axis searched for with the left parallax detection means, the horizontal difference of a vanishing point, the symmetry axis searched for with the right parallax detection means, and the horizontal difference of a vanishing point to the front is detected.

[0011] In this invention, the rotation signal of the direction of a yaw is outputted with the direction camera rotation signal output means of a yaw. Moreover, with the direction rotation means of a left image input yaw A left road image input means is rotated according to the signal from the direction camera rotation signal output means of a yaw. With a left road image input means It is carried in the left-hand side of vehicles, and the front of vehicles is photoed. With a left image transit rain detection means A transit lane is detected using the image data from a left image input means, and it is transposed to a straight line. With a left image vanishing point detection means It asks for the vanishing point on an image from the straight line detected with the left image transit rain detection means. With a left image disappearance line detection means Based on the rotation signal from the direction camera rotation signal output means of a yaw, draw the vanishing point from a left image vanishing point detection means on image data, and it asks for a disappearance line. The location data on the image of a disappearance line is stored in the camera setting data base. With a left image input amendment angle detection means The amendment angle of whenever [angle-of-inclination] is searched for from the location of the disappearance line on the image from [from the disappearance line on the image from a left image disappearance line detection means] the amendment angle and camera setting data base of the circumference of the optical axis of a left image input means. With the circumference rotation means of a left image input optical axis It is made to rotate to the circumference of the optical axis of a left road image input means based on the amendment angle of the circumference of the optical axis searched for with the left image input amendment angle detection means. With a left image input inclination modification means Based on the amendment angle of the angle of inclination searched for with the left image input amendment angle detection means, amend the inclination of a left road image input means, and the same thing also about right-hand side A direction rotation means of a right image input yaw to rotate a right road image input means according to the signal from the direction camera rotation signal output means of a yaw, A right road image input means, a right image transit rain detection means, a right image vanishing point detection means, a right image disappearance line detection means, a right image input amendment angle detection means, the circumference rotation means of a right image input

optical axis, and a right image input inclination modification means perform.
[0012] In this invention, forward vehicle both the closing rate detection means detects the closing rate of front vehicles from the distance information from the self-vehicles of the fixed time interval from a distance detection means to front vehicles. Moreover, with a collision time amount count means Collision time amount is found from the distance to the front vehicles from a distance detection means, and the closing rate of the front vehicles from forward vehicle both the closing rate detection means, and it tells that an operator has the possibility of a collision from the collision anticipation time amount from a collision time amount count means with a warning means.
[0013]
[Example] Hereafter, the example of this invention is explained with reference to a drawing.
[0014] First, it attaches and explains to one example of the distance-between-two-cars metering device of this invention. In drawing 1 , 10 is a left road image input means to be carried in the left-hand side of vehicles and to photo the front of vehicles. It is a left image transit rain detection means for 11 to detect the white line of a transit lane using the image data from said left road image input means 10, and to approximate it as a straight line, and 12 is a left image vanishing point detection means to find an intersection from two straight lines detected with the left image transit rain detection means 11. 13 is a left image symmetry-axis detection means to ask for the field of the lane self-vehicles are running from two straight lines detected with the front image from the left road image input means 10, and the left road transit rain detection means 11, and to detect the symmetry axis of the front vehicles in the field. 14 is a left parallax extract means to search for a symmetry axis and the difference in the horizontal direction of a vanishing point using the symmetry axis detected with the left image symmetry-axis detection means 13, and the vanishing point detected with the left image vanishing point detection means 12.
[0015] 15 is a right road image input means to be carried in the right-hand side of vehicles and to photo the front of vehicles. It is a right image transit rain detection means for 16 to detect the white line of a transit lane using the image data from said right road image input means 15, and to approximate it as a straight line, and 17 is a right image vanishing point detection means to find an intersection from two straight lines detected with the right image transit rain detection means 16. 18 is a right image symmetry-axis detection means to ask for the field of the lane self-vehicles are running from two straight lines detected with the front image from the right road image input means 15, and the right road transit rain detection means 16, and to detect the symmetry axis of the front vehicles in the field. 19 is a right parallax extract means to search for a symmetry axis and the difference in the horizontal direction of a vanishing point using the symmetry axis detected with the right image symmetry-axis detection means 18, and the vanishing point detected with the right image vanishing point detection means 17. 101 is a distance detection means to use the symmetry axis searched for with the left parallax extract means 14, the difference in the horizontal direction of a vanishing point, and the symmetry axis searched for with the right parallax extract means 19 and the difference in the horizontal direction of a vanishing point, and to find the distance from self-vehicles to front vehicles.
[0016] Actuation of the above-mentioned example is explained below.
[0017] The brightness image ahead of the vehicles shown in the left-hand side of drawing 4 from the left road image input means 10 attached in the left-hand side of vehicles at every fixed time amount **t is captured. An edge is taken with the left image transit rain detection means 11 from this brightness image, binary-ization is performed, and the white line of the lane in an image is detected as a straight line using the Hough conversion which asks for a straight line. It asks for a linear intersection (xdl, ydl) with the left image vanishing point detection means 12 using two straight lines of this lane. On the other hand with the left image symmetry-axis detection means 13, the rain field which is running self-vehicles using the brightness image from the left road image input means 10 and two straight lines from the left image transit rain detection means 11 is started. A level edge is found in the started field and suppose that they are this front vehicles. In this, vehicles use that there are many level edge components. When the x-coordinate of the i-th point of a level edge component is set to xlhi and the number of all points of a level edge point is set to nl, the x-coordinate xls of a symmetry axis with a level edge is as follows.

[0018] The left parallax dl is searched for as follows with the xls=(sigmai=1nl xlhi)/nl left parallax extract means 14 from the x-coordinate xdl of a vanishing point, and the x-coordinate xls of a symmetry axis.
[0019] It is made the dl=|xdl-xls| said appearance and the brightness image ahead of the vehicles shown in the right-hand side of drawing 4 from the right road image input means 15 attached in the right-hand side of vehicles at every fixed time amount **t is captured. An edge is taken with the right image transit rain detection means 16 from this brightness image, binary-ization is performed, and the white line of the lane in an image is detected as a straight line using the Hough conversion which asks for a straight line. Two straight lines of this lane are used and it is a linear intersection (xdr, ydr) with the right image vanishing point detection means 17. It asks. On the other hand with the right image symmetry-axis detection means 18, the rain field which is running self-vehicles using the brightness image from the right road image input means 15 and two straight lines from the right image transit rain detection means 16 is started. A level edge is found in the started field and suppose that they are this front vehicles. When the x-coordinate of the i-th point of a level edge component is set to xrhi and the number of all points of a level edge point is set to nr, the x-coordinate xrs of a symmetry axis with a level edge is as follows.
[0020] The left parallax dr is searched for as follows with the xrs=(sigmai=1nr xrhi)/nr right parallax extract means 19 from the x-coordinate xdr of a vanishing point, and the x-coordinate xrs of a symmetry axis.
[0021] dr=|xdr-xrs|, then the distance detection means 101 find the distance D to front vehicles as follows.
[0022] D=Lf/(dl+dr)
L is the gap of a road image input means on either side, and f is the focal distance of a lens here.
[0023] Below, drawing 2 is used and explained about one example of the camera location compensator of this invention.
[0024] In drawing 2 , 20 is a direction camera rotation signal output means of a yaw to output the signal which makes the road image input means 22,202 on either side turn in the direction of a yaw, respectively, and 21 is a direction rotation means of a left image input yaw to rotate the left road image input means 22 in the direction of a yaw according to the signal from the direction camera rotation signal output means 20 of a yaw. 22 is a left road image input means to be carried in the left-hand side of vehicles and to photo the front of vehicles. It is a left image transit rain detection means for 23 to detect the white line of a transit lane using the image data from said left road image input means 22, and to approximate it as a straight line, and 24 is a left image vanishing point detection means to find an intersection from two straight lines detected with the left image transit rain detection means 23. 25 is a left image disappearance line detection means to ask for a disappearance line from the location of the vanishing point from said left image vanishing point detection means 24, when the signal from the direction camera rotation signal output means 20 of a yaw is received. 26 is a camera setting data base containing the location data on the image of a disappearance line, and 27 is a left image input amendment angle detection means receive the location data on the image of the disappearance line from the location and the camera setting data base 26 of a disappearance line from the left image disappearance line detection means 25, and detect the amount of angle-of-rotation amendments of the left road image input means 22. 28 is a circumference rotation means of a left image input optical axis rotate said left road image input means 22 around an optical axis from the amount of amendments of the circumference of the optical axis from the left image input amendment angle detection means 27, and 29 is a left image input inclination modification means change the inclination of said left road image input means 22 from the amount of inclination amendments from said left image input amendment angle detection means 27.
[0025] On the other hand, 201 is a direction rotation means of a right image input yaw to rotate the right road image input means 202 in the direction of a yaw according to the signal from said direction camera rotation signal output means 20 of a yaw. 202 is a right road image input means to be carried in the right-hand side of vehicles and to photo the front of vehicles. It is a right image transit rain detection

means for 203 to detect the white line of a transit lane using the image data from said right road image input means 202, and to approximate it as a straight line, and 204 is a right image vanishing point detection means to find an intersection from two straight lines detected with the right image transit rain detection means 203. If the signal from the direction camera rotation signal output means 20 of a yaw is received, 205 It is a right image disappearance line detection means to ask for a disappearance line from the location of the vanishing point from said right image vanishing point detection means 204. 206 is a right image input amendment angle detection means to receive the location data on the image of the disappearance line from the location and the camera setting data base 26 of a disappearance line from the right image disappearance line detection means 205, and to detect the amount of angle-of-rotation amendments of the right road image input means 202. 207 is a circumference rotation means of a right image input optical axis rotate said right road image input means 202 around an optical axis from the amount of amendments of the circumference of the optical axis from the right image input amendment angle detection means 206, and 208 is a right image input inclination modification means change the inclination of said right road image input means 202 from the amount of inclination amendments from said right image input amendment angle detection means 205.

[0026] Actuation of the above-mentioned example is explained below.

[0027] When a power supply is switched on, the signal which rotates a camera in the direction of a yaw comes out from the direction camera rotation signal output means 20 of a yaw. According to it, the left road image input means 22 rotates in the direction of a yaw with the direction rotation means 21 of a left image input yaw. Two straight lines are detected by this rotation by each image with said left image rain detection means 23, the vanishing point in each image is called for with said left image vanishing point detection means 24, and a disappearance line is called for as the left image disappearance line detection means 25 is shown in the left of drawing 5 using it. It asks for angle thetal which the perpendicular which passes along the center of an image by the left image input amendment angle detection means 27 like [on the left of drawing 5] first, and the perpendicular taken down from the center of an image to the disappearance line accomplish. What is necessary is just to rotate a camera in the direction of the perpendicular which this took down from the center of a perpendicular to an image that a direction passes along the center of an image at the angle of rotation of the circumference of an optical axis to the disappearance line. Therefore, only angle thetal rotates the left road image input means 22 in the direction of previous around an optical axis with the circumference rotation means 28 of a left image input optical axis. Although the inclination amendment angle of the left road image input means 22 is furthermore searched for with the left image input amendment angle detection means 27 Since the amount of amendments changes with lenses, beforehand, in quest of the distance in an image, and the angle to change, put into the camera setting data base 26, and it places. If the distance of an image center and the perpendicular direction from the image base to the disappearance line which amended rotation of the circumference of an optical axis is found, the amount of amendments will be calculated based on the disappearance line setting location on the image from the camera setting data base 26. With the left image input inclination modification means 29, the inclination of the left road image input means 22 is amended according to the amount of amendments.

[0028] The signal which rotates a camera in the direction of a yaw comes out from the direction camera rotation signal output means 20 of a yaw similarly. According to it, the right road image input means 202 rotates in the direction of a yaw with the direction rotation means 201 of a right image input yaw. Two straight lines are detected by this rotation by each image with the right image rain detection means 203, the vanishing point in each image is called for with said right image vanishing point detection means 204, and a disappearance line is called for as the right image disappearance line detection means 205 is shown in the right of drawing 5 using it. It asks for angle thetar which the perpendicular which passes along the center of an image by the right image input amendment angle detection means 206 like [on the right of drawing 5] similarly first, and the perpendicular taken down from the center of an image to the disappearance line accomplish. Since this is the angle of rotation of the circumference of an optical axis, only angle thetar rotates the right road image input means 202 in the direction of previous around an optical axis with the circumference rotation means 207 of a right image input optical axis that

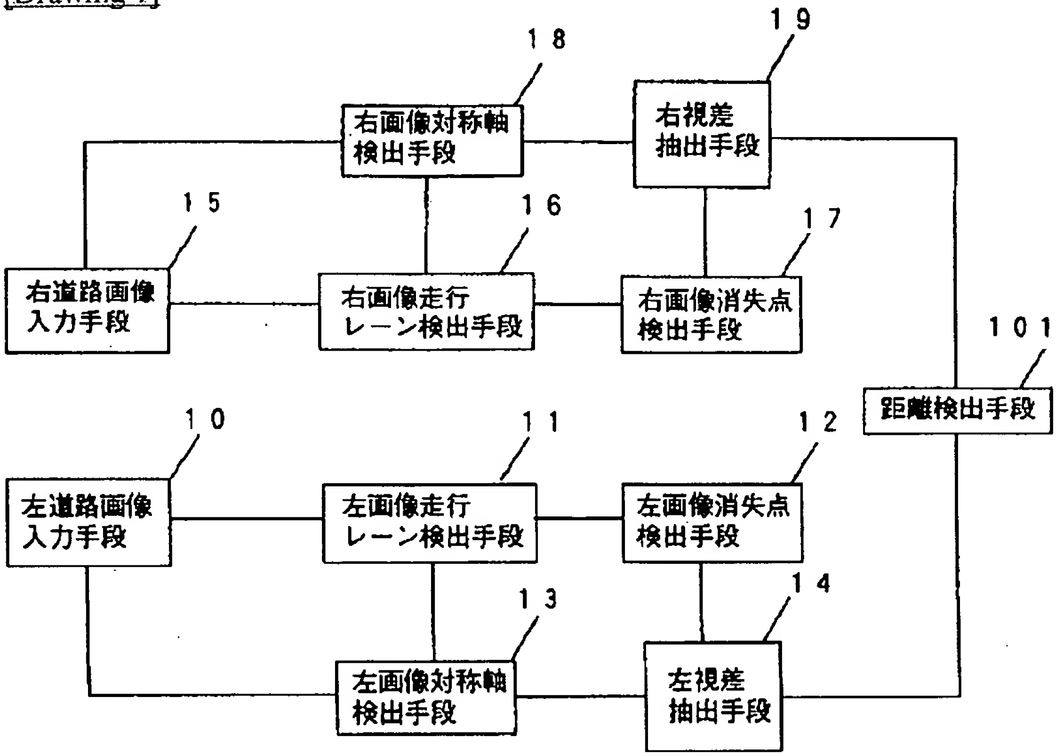
a direction should just rotate a camera from the perpendicular passing through the center of an image in the direction of the perpendicular taken down from the center of an image to the disappearance line. If a vertical distance is furthermore found from the image base to the disappearance line which amended rotation of the circumference of an image center and an optical axis, the amount of amendments will be calculated based on the disappearance line setting location on the image from the camera setting data base 26. With the right image input inclination modification means 208, ****** amends the inclination of the **** road image input means 202 in the amount of amendments.
[0029] Below, drawing 3 is used and explained about one example of the collision warning device of this invention.
[0030] In drawing 3 , each means which reaches 10-19 and is shown with the sign of 101 is the same as the thing of the example of drawing 1 . That is, 10 is a left road image input means to be carried in the left-hand side of vehicles and to photo the front of vehicles. It is a left image transit rain detection means for 11 to detect the white line of a transit lane using the image data from said left road image input means, and to approximate it as a straight line, and 12 is a left image vanishing point detection means to find an intersection from two straight lines detected with the left image transit rain detection means of 11. 13 is a left image symmetry-axis detection means to ask for the field of the lane self-vehicles are running from two straight lines detected with the front image from the left road image input means of 10, and the left road transit rain detection means of 11, and to detect the symmetry axis of the front vehicles in the field. 14 is a left parallax extract means to search for a difference in the horizontal direction of a symmetry axis and a vanishing point using the symmetry axis detected with the left image symmetry-axis detection means of 13, and the vanishing point detected with the left image vanishing point detection means of 12. 15 is a right road image input means to be carried in the right-hand side of vehicles and to photo the front of vehicles. It is a right image transit rain detection means for 16 to detect the white line of a transit lane using the image data from said right road image input means, and to approximate it as a straight line, and 17 is a right image vanishing point detection means to find an intersection from two straight lines detected with the right image transit rain detection means of 16. 18 is a right image symmetry-axis detection means to ask for the field of the lane self-vehicles are running from two straight lines detected with the front image from the right road image input means of 15, and the right road transit rain detection means of 16, and to detect the symmetry axis of the front vehicles in the field. 19 is a right parallax extract means to search for a difference in the horizontal direction of a symmetry axis and a vanishing point using the symmetry axis detected with the right image symmetry-axis detection means of 18, and the vanishing point detected with the right image vanishing point detection means of 17. 101 is a distance detection means to find the distance from self-vehicles to front vehicles using the symmetry axis searched for with the left parallax extract means of 14, the difference in the horizontal direction of a vanishing point, the symmetry axis searched for with the right parallax extract means of 19, and the difference in the horizontal direction of a vanishing point.
[0031] Furthermore, 30 is forward vehicle both closing rate detection means to ask for the relative velocity to the self-vehicles of front vehicles from the distance to the front vehicles for which it asked for every fixed time amount with said distance detection means 101, and 31 is a collision time amount count means to predict collision time amount with self-vehicles from forward vehicle both the closing rate detection means 30 and said distance detection means 101. If the collision time amount of 32 found with said collision time amount count means 31 is shorter than fixed time amount, it is a warning device which takes out warning to an operator.
[0032] Actuation of the above-mentioned example is explained below.
[0033] The distance detection means 101 of said first example detects the distance D to front vehicles, and variation **D between **t is calculated by 30 from distance D' to the front vehicles**t-hour before forward vehicle both the closing rate detection means.
[0034] It is judged that it will not approach with the **D=D'-D collision time amount count means 31 if it becomes **D<=0. If it becomes **D>0, the time amount tc which collides will be found.
[0035] tc=**t.D-/**D is also carried out, and if time amount tc is smaller than fixed time amount T, it will be judged that the possibility of a collision is small. If larger than T, it will judge that the possibility

of a collision is high and will warn an operator with the collision warning means 32.
[0036] Thus, this invention can measure distance by small computational complexity by searching for the symmetry axis of front vehicles by each image using the right-and-left road image captured with the image input means attached in right and left ahead of vehicles.
[0037] Moreover, in quest of angle of rotation of the circumference of the optical axis of a camera, and whenever [angle-of-inclination], this is amended from the migration locus of the vanishing point which approximated the detected white line in a straight line, and asked for it by moving an image input means on either side in the direction of a yaw.
[0038] Moreover, in quest of collision anticipation time amount, warning is given to an operator from the closing rate and the distance between two cars of front vehicles.
[0039] In addition, it cannot be overemphasized that the criteria of warning of this invention are not restricted to the mode in the above-mentioned example.
[0040] In addition, each means of this invention is realizable using the hard circuit of the dedication which is realized by software using a computer or has each [these] function.
[0041]
[Effect of the Invention] It has the advantage in which there is little computational complexity, and this invention can measure the distance to front vehicles, amendment of a road image input means can do it using an image, and collision anticipation time amount can be taken out, and the alarm of the collision can be carried out to an operator so that clearly from the place described above.

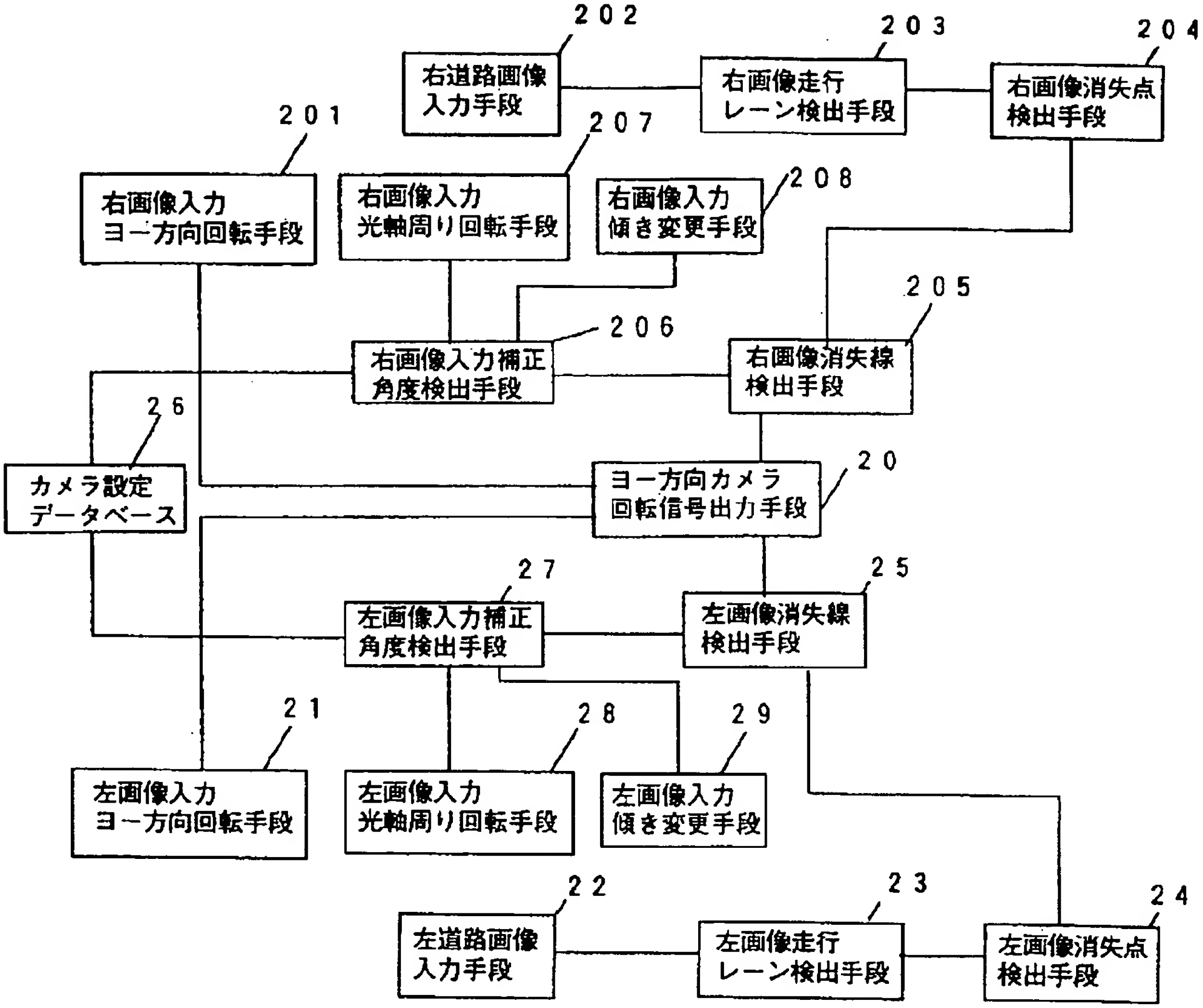
[Translation done.]

DRAWINGS

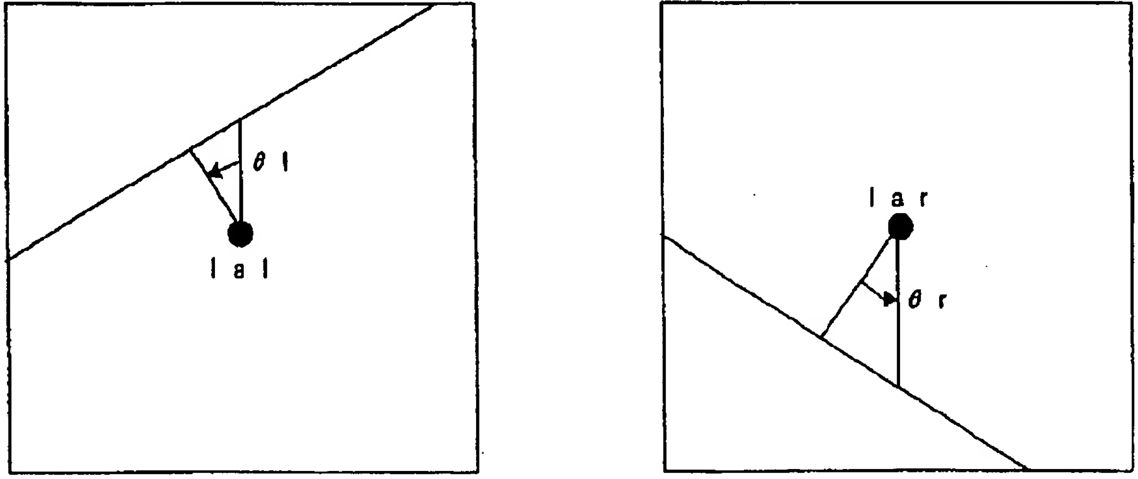
[Drawing 1]


18
右画像対称軸
検出手段
19
右視差
抽出手段
15
16
17
右道路画像
入力手段
右画像走行
レーン検出手段
右画像消失点
検出手段
101
距離検出手段
10
11
12
左道路画像
入力手段
左画像走行
レーン検出手段
左画像消失点
検出手段
13
14
左画像対称軸
検出手段
左視差
抽出手段

[Drawing 2]

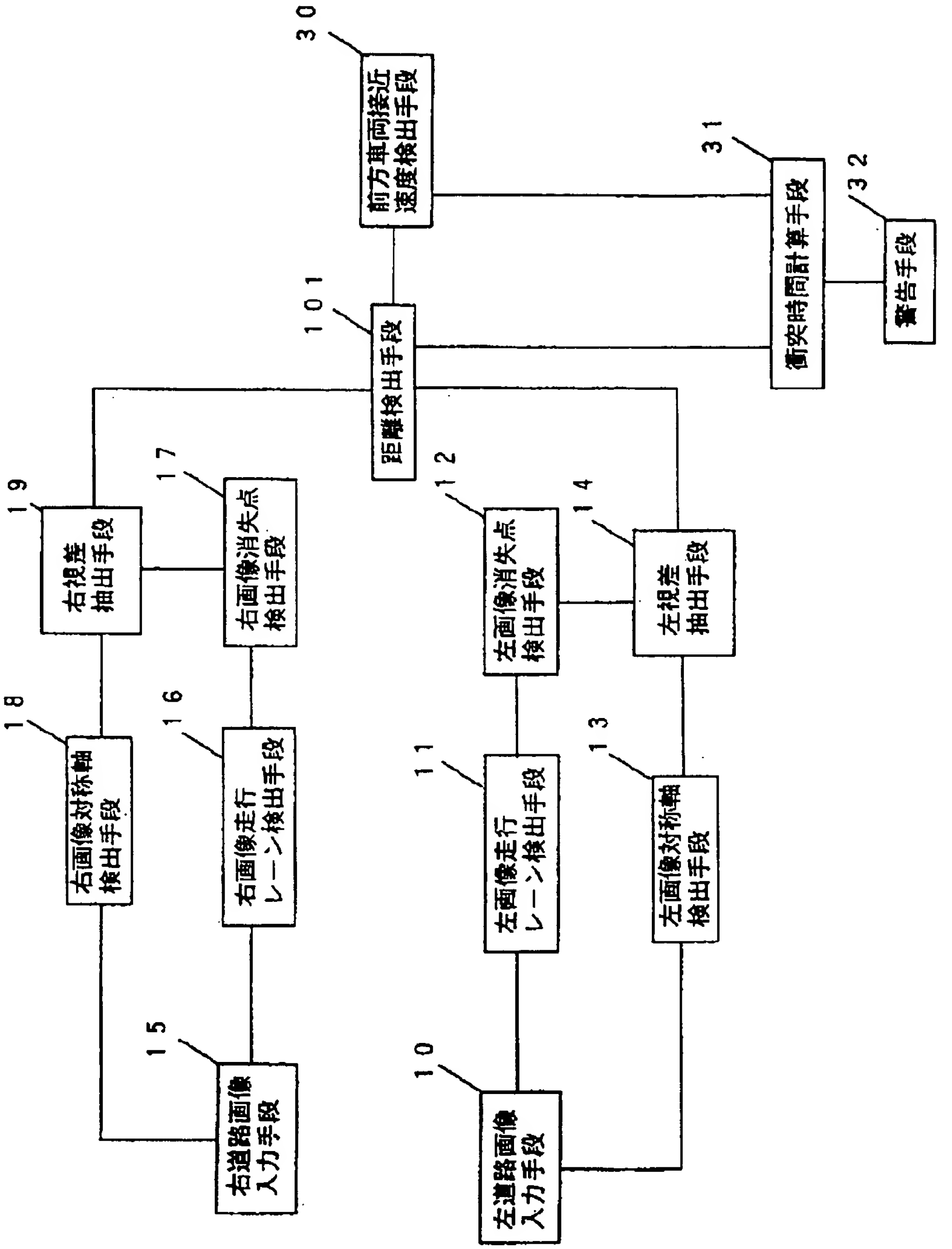

202
右道路画像入力手段
203
右画像走行レーン検出手段
204
右画像消失点検出手段
201
右画像入力ヨー方向回転手段
207
右画像入力光軸周り回転手段
208
右画像入力傾き変更手段
205
206
右画像入力補正角度検出手段
右画像消失線検出手段
26
カメラ設定データベース
20
ヨー方向カメラ回転信号出力手段
27
25
左画像入力補正角度検出手段
左画像消失線検出手段
21
28
29
左画像入力ヨー方向回転手段
左画像入力光軸周り回転手段
左画像入力傾き変更手段
22
23
24
左道路画像入力手段
左画像走行レーン検出手段
左画像消失点検出手段

[Drawing 5]

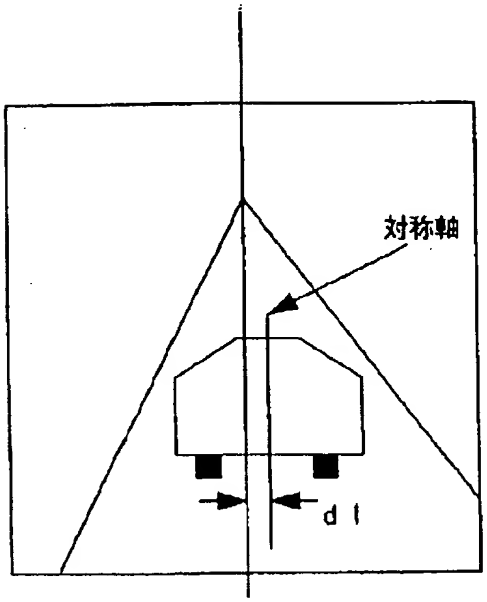

θ l
l a l
l a r
θ r

左画像　　　　右画像

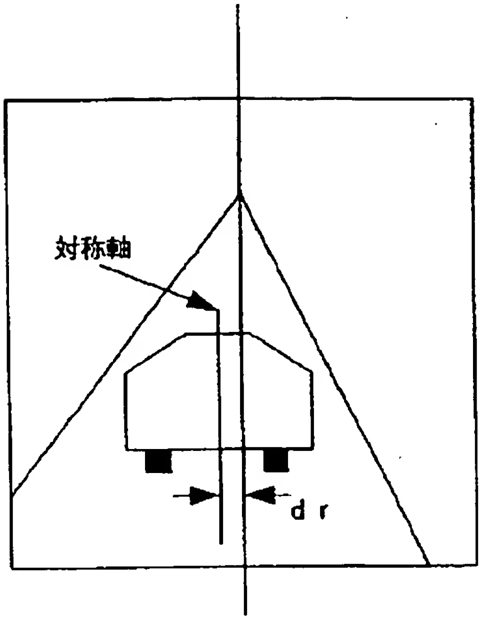
[Drawing 3]


30
前方車両接近速度検出手段
31
衝突時間計算手段
32
警告手段
101
距離検出手段
19
右視差抽出手段
17
右画像消失点検出手段
12
左画像消失点検出手段
14
左視差抽出手段
18
右画像対称軸検出手段
16
右画像走行レーン検出手段
11
左画像走行レーン検出手段
13
左画像対称軸検出手段
15
右道路画像入力手段
10
左道路画像入力手段

[Drawing 4]



左画像



右画像

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the block diagram of one example of the distance-between-two-cars metering device of this invention.
[Drawing 2] It is the block diagram of one example of the camera compensator of this invention.
[Drawing 3] It is the block diagram of one example of the collision warning device of this invention.
[Drawing 4] This invention is explanatory drawing of right-and-left parallax detection.
[Drawing 5] It is explanatory drawing of the amendment method of the road image input means in this invention.
[Description of Notations]
10 Left Road Image Input Means
11 Left Image Transit Rain Detection Means
12 Left Image Vanishing Point Detection Means Means
13 Left Image Symmetry-Axis Detection Means
14 Left Parallax Extract Means
15 Right Road Image Input Means
16 Right Image Transit Rain Detection Means
17 Right Image Vanishing Point Detection Means Means
18 Right Image Symmetry-Axis Detection Means
19 Right Parallax Extract Means
101 Distance Detection Means

[Translation done.]